4 Waveform File Formats

Overview

[@k file format, format,, file]

This section provides a list of the various file formats supported directly and indirectly by Signalogic DSP software. There are three levels of waveform file format support:

1. Format is supported directly by software. Software functions either read format automatically by using a search based on waveform format filename extension, or require a waveform filename extension to be entered explicitly.
2. Format can be converted by utility function to a format supported directly by software. If waveform file format has a header, all values and attributes will be converted that have counterparts in the directly supported format.
3. Format can be "imported", using a general-purpose File Acquisition or similar utility to convert file data into a format directly supported by the software. In this case, if the waveform file format has a header, it is likely that some header values and attributes may not be converted fully, or lost.

Main Topics

Hypersignal Waveform File Format
Microsoft .WAV Waveform File Format
MATLAB Waveform File Format
Acoustic/Audio Waveform File Formats
Techron .TDS File Format
Ariel SYSid File Format
Micro Technology Unlimited .SF File Format

4.1 Hypersignal Waveform File Format

Below is a quick reference for version 4.x and higher Hypersignal waveform file format. For additional, detailed information about individual values in the Hypersignal waveform file format, see Hypersignal-Macro Series Users Manual chapter 5, Hypersignal Waveform File Format.

Table 1 Hypersignal Waveform File Format Quick Reference

Name	Word[1] Index	Size / Type
SHORT HEADER		
Maximum Amplitude	0	word
Framesize	1	word
Sampling Frequency remainder[2]	2	integer (0 to 32766)
FFT Order	3 (b7-b0)	byte
Amplitude Exponent	3 (b15-b8)	byte
Waveform Number of Elements (NE) remainder	4	integer (0 to 16383)
Frame Overlap	5	word
Data Type Attributes	6	

Time Domain Source	6 (b1-b0)	2 bits
Extended Header Attribute	6 (b2)	1 bit
Complex Attribute	6 (b3)	1 bit
LPC Order	6 (b8-b4)	5 bits
Window Type	6 (b11-b9)	3 bits
Amplitude Exponent	6 (b15-b12)	4 bits
Number of Channels	7 (b5-b0)	6 bits
Nyquist FFT pt. Attribute	7 (b6)	1 bit
Autoscale Attribute	7 (b7)	1 bit
User-Defined	7 (b15-b8)	byte
Sampling Frequency quotient[2]	8	integer (0 to 32767)
Waveform Number of Elements (NE) quotient	9	integer (0 to 32767)
EXTENDED HEADER		
Minimum Amplitude	10	word
Calibration Offset	11	single
Gain1	13	single
Gain2	15	single
Data Precision	17	word
Inp Level[3]	18	single
Start Freq	20	single
Extended Framesize[4]	22	doubleword
FFT Size	24	doubleword
Extended Frame Overlap[5]	26	doubleword
Floating-Point Amplitude	28	double
Transform Window Scale Value	32	single
Reserved for Signalogic Use	**34**	**14 words**
User-Defined	**48**	**16 words**
Start of Waveform Data	**64**	**NE integers**

Notes

[1] Unless otherwise mentioned, words are 16-bit unsigned integers ranging in value from 0..65535, integers are 16-bit values ranging from -32768..32767, doublewords are 32-bit unsigned integers ranging in value from 0..4294967295, singles are IEEE format 32-bit floating-point values, and doubles are IEEE format 64-bit floating-point values.

[2] See Hypersignal-Macro Series Users Manual chapter 5, Hypersignal Waveform File Format, for explanation on Sampling Frequency remainder, quotient and Waveform length remainder and quotient

[3] The QUANT field in earlier versions of Hypersignal has been removed. Its value is now contained as part of the multiplier in the Inp Level field. The new Inp Level value is calculated as 2**(QUANT-15)

[4] Valid only when Framesize field is zero.

[5] Valid only when Frame Overlap field is zero.

General Waveform File Format Topics

Hypersignal Waveform File Format

Microsoft .WAV Waveform File Format

Additional Notes About .WAV File Limitations

MATLAB Waveform File Format

Acoustic/Audio Waveform File Formats

Techron .TDS File Format

Ariel SYSid File Format

Micro Technology Unlimited .SF File Format

4.2 Microsoft .WAV Waveform File Format

The "standard" Microsoft .WAV file format, unless modified by user-defined extension, is exclusively a time domain format. By standard, we mean .WAV files shipped with Windows 3.x and popular off-the-shelf multimedia products. The standard format contains a simple 44-

byte header, which allocates no values for frequency domain information, wavelet domain information, or for other math/DSP analysis purposes. Furthermore, although the .WAV format is theoretically a subset of the general Microsoft RIFF format, and can thus be extended to contain user-defined header sections, experience at Signalogic has shown that most off-the-shelf software packages fail to ignore sections they do not understand, and either crash or process incorrect data.

Below is a quick reference for standard .WAV file formats. See the *Microsoft Windows Multimedia Programmer's Reference*, chapter 8, for detailed information on the .WAV format. Also, see the topic Hypersignal Tim2Wav and Wav2Tim Waveform File Conversion, in Signalogic DSP Software System Guide section 1.2.1, Summary Of Hypersignal-Macro Series Software.

Table 2 Microsoft WAVE File Format Quick Reference

Name	Word[1] Index	Size / Type
SHORT HEADER		
'RIFF" section tag	0	4 bytes
Length of RIFF section	2	doubleword
'WAVE' format identifier	4	4 bytes
'fmt ' section tag	6	4 bytes
Length of fmt section	8	doubleword
PCM identifier	10	word
Number of Channels	11	integer
Sampling Frequency	12	doubleword
Average Bytes Per Second	14	doubleword
Block Alignment	16	integer
Precision (8-bit or 16-bit)	17	word
'data' section tag	18	4 bytes
Length of data section (NB)	20	doubleword
Start of Waveform Data	**22**	**NB/2 words**

Notes

[1] Unless otherwise mentioned, words are 16-bit unsigned integers ranging in value from 0..65535, integers are 16-bit values ranging from -32768..32767, doublewords are 32-bit unsigned integers ranging in value from 0..4294967295, singles are IEEE format 32-bit floating-point values, and doubles are IEEE format 64-bit floating-point values.

General Waveform File Format Topics

Hypersignal Waveform File Format

Microsoft .WAV Waveform File Format

Additional Notes About .WAV File Limitations

MATLAB Waveform File Format

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Additional Notes About .WAV File Limitations

There are several limitations to the de facto standard 44-byte header .WAV format found in use with most multimedia programs. One of the most noticeable is the lack of maximum amplitude value, which causes .WAV files to be displayed and processed in Hypersignal and DSPower software as if they always contained full-scale values. Another is lack of frequency or wavelet domain information. These are severe limitations when working with Hypersignal or DSPower software, and it is strongly recommended that, at the earliest opportunity, you convert your .WAV files into Hypersignal .TIM format one of the following ways:

1. Use the Wav2Tim conversion function either from the Hypersignal Macro Manger menu or as a DSPower-Block Diagram block.

2. Use File Acquisition function, either from Hypersignal or as DSPower-Block Diagram block.

3. Use the .WAV file as direct input into Hypersignal or DSPower-Block Diagram function, by specifying the .WAV extension explicitly in an input waveform filename field.

4.3 MATLAB Waveform File Format

Section not available yet.

General Waveform File Format Topics

Hypersignal Waveform File Format

Microsoft .WAV Waveform File Format

Additional Notes About .WAV File Limitations

MATLAB Waveform File Format

Acoustic/Audio Waveform File Formats

Techron .TDS File Format

Ariel SYSid File Format

Micro Technology Unlimited .SF File Format

4.4 Acoustic/Audio Waveform File Formats

Mainly due to the influence of Hypersignal-Acoustic, information is available for some popular acoustic/audio analysis formats in the following sections.

Acoustic/Audio Waveform File Formats

4.4.1 Techron .TDS File Format

The .TDS file format is a frequency domain ASCII (text file) format used by Techron with their popular TEF20 analyzer system and SoundLab software. A tefrd.mac function is included with Hypersignal-Acoustic software, which can convert Techron .TDS files into Hypersignal .FRQ, .PHZ, and .REA/.IMA waveform files. These files can then be used directly in Hypersignal frequency domain functions and displays, including iFFT to produce equivalent time domain responses, and the equalize.mac function, to produce equalizing time domain responses.

The tefrd.mac function invokes the tefrd.exe utility, for which source code is included with Hypersignal-Acoustic software. Please see this source code for further information on the .TDS file format.

General Waveform File Format Topics

Hypersignal Waveform File Format

Microsoft .WAV Waveform File Format

Additional Notes About .WAV File Limitations

MATLAB Waveform File Format

Acoustic/Audio Waveform File Formats

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Ariel SYSid File Format

Micro Technology Unlimited .SF File Format

4.4.2 Ariel SYSid File Format

The .DAT file format is a frequency domain ASCII (text file) format used by Ariel with their popular SYSid analyzer system and software. A sysidrd.mac function is included with Hypersignal-Acoustic software, which can convert Ariel .DAT files into Hypersignal .FRQ, .PHZ, and .REA/.IMA waveform files. These files can then be used directly in Hypersignal frequency domain functions and displays, including iFFT to produce equivalent time domain responses, and the equalize.mac function, to produce equalizing time domain responses.

The sysidrd.mac function invokes the sysidrd.exe utility, for which source code is included with Hypersignal-Acoustic software. Please see this source code for further information on SYSid file formats.

General Waveform File Format Topics

Hypersignal Waveform File Format

Microsoft .WAV Waveform File Format

Additional Notes About .WAV File Limitations

MATLAB Waveform File Format

Acoustic/Audio Waveform File Formats

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Ariel SYSid File Format

Micro Technology Unlimited .SF File Format

4.4.3 Micro Technology Unlimited .SF File Format

Micro Technology Unlimited (MTU) .SF format waveform files can be imported into Hypersignal-Macro series software or DSPower software formats using the File Acquisition function. Use the following settings:

- format set to 'BIN'
- sample width set to 4 (16-bit)
- bytes to discard set to 1024 for mono or stereo waveform input, or set to 1026 to import only channel B from a stereo waveform file
- number of samples to acquire set to 0 (all)
- sampling frequency set to appropriate value
- channel strip set to 0 for mono or stereo waveform input, or set to 1 to import either only channel A or channel B from a stereo waveform file

- number of channels set to 1 for mono acquisition, or 2 for stereo acquisition

General Waveform File Format Topics

Hypersignal Waveform File Format

Microsoft .WAV Waveform File Format

Additional Notes About .WAV File Limitations

MATLAB Waveform File Format

Acoustic/Audio Waveform File Formats

Techron .TDS File Format

Ariel SYSid File Format

Micro Technology Unlimited .SF File Format